REMARKS

The Amendments

Claims 4 and 5 have been amended to particularly point out and distinctly claim the subject matter Applicants regard as the invention. The new claims are supported by the original claims and throughout the specification. In claim 4, the word 'highly' has been removed, thus removing any source of indefiniteness. Claim 5 now has been amended to clarify that the sample is activated by neutron or gamma rays. Amended claim 5 is supported in particular by original claim 1. Applicants respectfully submit that these amendments add no new matter to the specification and earnestly solicit favorable action thereon.

The Drawing

Drawing Fig. 1 was amended to include the phrase "Prior Art" to properly identify this figure as prior art, as described at page 3, lines 12-13. A substitute drawing figure and a copy of the original drawing annotated to illustrate the addition of "Prior Art" (and re-positioning of the "Fig. 1" legend) was filed with the previous response. Although receipt of the drawing was acknowledged in the Detailed Action mailed October 24, 2005, the Office Action Summary did not indicate acceptance of the drawing. Applicants respectfully request indication of acceptance of that drawing.

The Office Action

Claims 4 and 5 were pending. Claim 5 stands rejected under 35 U.S.C. § 112, first paragraph, for not complying with the enablement requirement. The office action asserts that the claim is directed to subject matter that is not described in the specification in a way that enables a skilled practitioner to make and use the invention because the specification is said not to disclose radioactivation of radionuclides by neutrons or gamma rays.

Both claims stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter Applicants regard as the invention. In particular, the term 'highly' is identified as not providing the requisite degree of certainty in the claims.

All claims stand rejected under 35 U.S.C. § 103(a) as unpatentable over any of Cole, Schultz, Horrocks, or Gozani, in view of Vourvopoulos. Each of the primary references is cited for the teaching of coincidence counting using plural gamma ray detectors, and Vourvopoulos is cited for the teaching of comparing or fitting a measured spectrum to a know standard.

The Invention

The invention is directed to a method for qualitatively and quantitatively characterizing radionuclides in a sample comprising multiple nuclides. The method can be used to identify and quantify a small quantity of nuclide in a mixture. In accordance with the invention, two gamma-rays are pre-selected for each nuclide. These two gamma-rays are selected from among the many such rays emitted by the nuclide. For many nuclides, many pairs of gamma-rays are selected, one pair for each nuclide. Then, each pair of rays is simultaneously detected with a multiple gamma-ray detector assembly. The rays are plotted on axes, and the intersection of two rays identifies a particular nuclide. The relative abundance of the nuclide is detected by the height (count) of the peak at the intersection position.

Claim 4 is directed to a method of sensitive qualitative and quantitative analysis of radionuclides in a sample by multiple gamma-ray detection. A pair of gamma-rays emitted concurrently from each of the radionuclides in a sample comprising radionuclides is detected simultaneously with a multiple gamma-ray detector assembly consisting of a plurality of gamma-ray detectors to determine energies of each of the concurrent pairs of gamma-rays. A two-

dimensional matrix is constructed by plotting the energy of one gamma-ray of the concurrent pair of gamma-rays on one of the two axes and the energy of the other gamma-ray on the other axis and making a peak for each radionuclide on the axis vertical to the two axes by plotting the count of each gamma-ray at each position plotted on the matrix. Each radionuclide is specified from the position of the peak on the matrix by referring to known data of gamma-rays emitted from each radionuclide, and the peak for each radionuclide is compared with a standard radiation source having known energy and intensity to measure the content of each radionuclide in the sample. In the method of claim 5, the sample is radioactivated with neutrons or gamma-rays.

Remarks

Applicants respectfully traverse the rejections. The claims have been amended to remove indefiniteness and to particularly point out and distinctly claim the subject matter Applicants regard as the invention. Further, Applicants respectfully submit that the invention is not suggested by the cited documents, whether considered alone or in the proposed combinations with Vourvopoulos. Neither the cited documents nor the proposed combinations suggest the claimed invention.

In particular, Applicants respectfully traverse the rejections as set forth below.

35 U.S.C. § 112, First Paragraph (Enablement)

Claim 5 stands rejected as not enabled. Applicants respectfully traverse this rejection. Claim 5 has been amended to clarify that the ***sample*** is radioactivated with neutrons or gamma rays. Claim 5 as amended clearly is enabled by the specification, for example, as described at page 8, lines 6-8, of the specification.

35 U.S.C. § 112, Second Paragraph

Both claims stand rejected for failing to particularly point out and distinctly claim the subject matter Applicants regard as the invention. Applicants respectfully traverse this rejection.

Claim 4 has been amended to delete the word 'highly' to particularly point out and distinctly claim the method of the invention. Applicants respectfully submit that removal of the potentially subjective term, which was said to prevent determination of the metes and bounds of the claims, traverses the rejection.

35 U.S.C. § 103(a)

Both claims stand rejected under 35 U.S.C. § 103(a) as unpatentable over any of Cole, Schultz, Horrocks, or Gozani in view of Vourvopoulos. Applicants respectfully traverse these rejections.

In particular, each of the primary references is characterized as teaching "coincidence counting using plural gamma ray detectors to measure a pair of coincident gamma rays." This teaching, taken together with the disclosure of Vourvopoulos regarding comparison to a standard, is said to make the claimed invention unpatentable.

Applicants respectfully traverse this rejection. Applicants respectfully submit that the proposed combinations do not suggest the claimed invention.

Applicants respectfully submit that rejection of the claims using the two characterizations set forth in the Office Action, i.e., 'coincidence counting' and 'comparison to a standard,' fails to consider the elements of the claim. The claim includes all the elements thereof, including generation of the described matrix for the qualification and quantification of the materials under review, and is not simply 'coincidence counting' and 'comparison to a standard.' The Office Action does not compare these two characterizations to the claims. Rather, the Office Action

operates on the assumption that these characterizations fairly represent the claims. They do not, and the rejection is respectfully traversed.

Comparison of the teachings of the cited documents, whether considered alone or in the proposed combinations, with the pending claims shows that the claims are allowable.

Cole discloses a system of multiple detectors for identification of specific isotopes in a high gamma-ray field, and describes that, when fission occurs, two fragments (fission products), perhaps up to several neutrons, and several gamma-rays are emitted (column 2, lines 17-38). These events occur in "prompt coincidence." Cole also discloses other properties and characteristics of these fragments and neutrons. Cole discloses how to determine the atomic mass of the light fragment in relationship to the atomic mass of the heavy fragment. Cole also teaches that observing gamma rays of one fragment make it possible to observe gamma rays for the other fragment and, for the data in question, with or without data about the neutrons, determine the fissioning element.

As shown in Fig. 4A and Fig. 4B, Cole relates to one-dimensional spectrum plotting – energy on horizontal axis and its count (intensity) on vertical axis. Further, Cole does not describe or suggest the two-dimensional matrix of gamma-ray energy used in the present invention. Indeed, Applicants respectfully submit that Cole does not suggests or disclose quantification of the fissionable materials. Cole discloses only *identification* of the fissionable materials, and is silent with regard to quantification.

Similarly, Schultz discloses a method for identification, and not quantification, of explosives. Schultz discloses a method for detecting explosive material which comprises the step of employing pulsed thermal neutron interrogation to form a nitrogen density image and an oxygen density image (column 2, lines 33-44). Schultz also neither describes nor suggests the

two-dimensional matrix of gamma-ray energy of the present invention. Schultz discloses that small quantities of explosive can be identified in accordance with the method claimed therein. However, Applicants respectfully submit that nowhere does Schultz suggest or disclose that the method disclosed therein can be used to quantify any explosive identified. The density images used in combination are used to identify, not to quantify, the composition in question.

Horrocks discloses a method of determining the radioactive source strength of a sample of a radionuclide which emits two coincidental quanta of radiation. However, as shown in Figures 1-3, the disclosure of Horrocks, like the disclosures of Cole and Schultz, relates to one-dimensional spectrum, plotting energy on horizontal axis and its count (intensity) on vertical axis. Horrocks does not describe or suggest the two-dimensional matrix of gamma-ray energy. Rather, Horrocks is directed to measurement of but a single radionuclide. Horrock's method requires measurement of both a single quantum and a concomitant pair of quanta for the purpose of identifying the presence of a selected composition.

Gozani discloses a method and an apparatus of detecting contraband within an object. Gozani's method comprises irradiating the object with beam of fast neutrons, measuring the emitted gamma-ray spectrum using a multiplicity of gamma-ray detectors, and constructing from the gamma-ray information three-dimensional images of the atomic nuclei spatial and density distributions (for example, claims 1 and 12).

Gozani discloses that various chemical elements (hydrogen, carbon, nitrogen, oxygen) emit known gamma rays when the elements are bombarded with fast neutrons. These gamma rays are considered in combination to predict whether the irradiated object contains contraband, such as an explosive. Applicants respectfully submit that, as with the other primary references, Gozani does not suggest or disclose quantification of the identified comparison. In particular,

the invention of Gozani does not relate to a two-dimensional matrix of gamma-ray energy of the present invention.

Vourvopoulos also is directed to identification, but not quantification, of substances such as explosives and drugs, but neutron irradiation and elemental evaluation. Vourvopoulos does not disclose or suggest a matrix as found in the claims herein.

Vourvopoulos discloses how to measure two separate spectra with one device. Vourvopoulos also teaches that the data thus obtained must be 'de-convoluted.' Each chemical element under study – as with Schultz and Gozani, carbon, hydrogen, nitrogen, and oxygen are the elements of interest – produces a known spectrum of gamma rays and neutrons, thus enabling identification of these elemental compounds and contraband such as explosives and drugs that contain them. However, there is no suggestion or disclosure in Vourvopoulos that the contraband can be quantified, and there certainly is no suggestion or disclosure relating to the matrix of the invention herein.

Applicants respectfully traverse this rejection under 35 U.S.C. § 103(a). Neither the primary nor the secondary documents, whether considered alone or in the proposed combinations, suggests or discloses the two-dimensional matrix of the invention. Indeed, quantification is not suggested or disclosed in these documents. Applicants respectfully submit that the teaching of Vourvopoulos regarding comparison to standards adds nothing relevant to the primary documents.

The Office Action asserts that the claimed method of plotting data is a mere expedient. Applicants respectfully submit that this assertion can be made only with impermissible hindsight and in view of the specification at hand. None of the primary documents disclose or suggest such a method, and knowledge of comparison techniques does nothing to fill the gap.

Applicants respectfully submit that there is nothing in any of the primary documents to suggest that the skilled practitioner look to Vourvopoulos for any reason. Cole discloses how to determine all the information to be obtained – no additional information or comparison is necessary. Schultz, Horrocks, and Gozani are directed to measurement of carbon, hydrogen, nitrogen, and oxygen, for which the spectra are well-known. The primary documents require nothing outside their four corners, so there would be no need to look to Vourvopoulos for guidance.

The Office Action asserts that the practitioner with skills sufficient to develop the information identified in the previous argument would be sufficiently skilled to develop the mere expedient of the matrix of the invention. In accordance with that assertion, the two-dimensional matrix is "nothing more than an expedient" to record data. However, Applicants respectfully submit that none of the prior art documents suggest such an expedient. The examiner reasons that a skilled practitioner who can execute the listed tasks characterized as 'skill of the art' in the response certainly can make a two-dimensional plot as claimed in the application.

Applicants respectfully submit that the assertion in the Office Action is not well-founded. Applicants respectfully submit that, in impermissible hindsight reconstruction, the assertion seeks to confuse the identified skills of a practitioner with the alleged ease of creating the claimed plots *after the plots are disclosed.* The assertion – that a practitioner having the identified skills would be able to generate the plot claimed in this application – is not an extension of skills, but rather an impermissible hindsight reconstruction.

Importantly, the claimed invention requires more than the simple idea the examiner finds obvious. The claimed invention requires identification of the radionuclides and construction of

the plot. The points identified in the response go to knowledge necessary to practice the invention, not knowledge *of* the invention.

In this hindsight reconstruction-based rejection, the Office Action has not considered every step in the claim, and argues that the skilled practitioner also can easily accomplish the step of 'making a peak'. Applicants respectfully submit that the 'skill of the practitioner' points of knowledge relate to information necessary to make the manipulations that produce the invention, not to knowledge of the invention itself.

That the skilled practitioner may have knowledge that enables practice of an invention or to come to an understanding of how an invention works, as that invention is described in the specification and claimed, does not mean that the claimed invention would have been obvious to that practitioner. For example, a skilled practitioner may know how to make a frame that allows a wheel to rotate and carry the frame, may know how to make a steerable wheel that could be connected to that frame, and may know that a seat could be applied to the frame. However, this knowledge does not enable the practitioner to put those parts together to make a particular wheeled vehicle. Applicants respectfully submit that the position taken in the Office Action would require that, without more, every wheeled vehicle – unicycle, bicycle, bicycle-built-for-two, wheeled cart, roller skates – would be obvious to that skilled practitioner. Applicants further submit that this position simply is not reasonable.

There exists a significant difference between Applicants' identification of specific points of knowledge of the practitioner and the allegation that the same practitioner would know how to make a graph. First, it is an oversimplification that does not consider the limitations of the claim. Second, it does not consider that knowledge of 'making a graph' is not the claimed invention.

Applicants respectfully submit that the nature of this rejection as an impermissible hindsight reconstruction becomes clear when one considers the basis for it recited in the Office Action. The Office Action states that "the same artisan can also make a two-dimensional plot of detected coincident energies." Applicants respectfully submit that the question properly asked when considering patentability is *not* whether a skilled practitioner *can* make these plots. Rather, the correct question is whether it would have been obvious to practice the claimed invention.

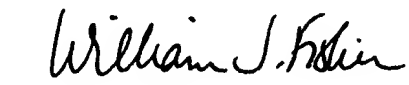
Thus, Applicants respectfully submit that although the skilled practitioner has the skills cited in the Office Action, these skills do not make the claimed invention unpatentable, for it is only with the teachings of the specification that the skilled practitioner would have knowledge of the invention. Just as the wheels, frames, and seats *can* be fashioned into various conveyances, whether any particular style 'would have been obvious' does not depend upon whether a practitioner 'can' make it. The same is true with regard to the invention here. Without the instructions in the specification, it would not have been obvious to the skilled practitioner to make the invention at hand.

Conclusion

Applicants respectfully submit that the application is in condition for allowance. Each of the formal rejections and the rejection on the merits has been traversed. The claims particularly point out and distinctly claim the subject matter Applicants regard as the invention and are definite and enabled, and Applicants respectfully submit that the claims are allowable on the merits. Favorable action is solicited.

Respectfully submitted,

Date: April 24, 2006

By: 

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